INSTRUMENT SYMBOL IDENTIFICATION LETTERS TABLE

	FIRST-LETTER		SUCCEEDING-LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION			CLOSE, STOP, DECREASE	
C	CONTROL			CONTROL	
D		DIFFERENTIAL	SENSOR (PRIMARY ELEMENT)	OPEN, START, INCREASE	
E	VOLTAGE				
F	FLOW RATE	RATIO (FRACTION)			FAIL
G			GLASS, VIEWING DEVICE		
H	HAND				HIGH OR OPEN
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW OR CLOSE
M	MOTOR, MOTION	MOMENTARY		MOTOR	MIDDLE INTERMEDIATE
N					STATUS (ON-OFF)
O			ORIFICE, RESTRICTION		OVERLOAD
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION	PUMP	
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		RELAY
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS	VELOCITY		VALVE, DAMPER LOUVER	
W	WEIGHT, FORCE		WELL		
X		X AXIS			
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR FINAL CONTROL ELEMENT	

EXPLANATORY NOTATIONS

SIGNAL CONVERTERS

NOTE 1: PROCESS OR INITIATING VARIABLE

2:
A = ANALOG
D = DIGITAL
E = VOLTAGE
F = FREQUENCY
H = HYDRAULIC
I = CURRENT
M = MOTOR
O = ELECTROMAGNETIC, SONIC
P = PNEUMATIC
PF = PULSE FREQUENCY
PD = PULSE DURATION
R = RESISTANCE

SMALL CIRCLE SIGNIFIES SIGNAL INVERSION

HAND SWITCHES

SELECTOR SWITCH (MAINTAINED CONTACT)

SPRING RETURN SWITCH OR PUSHBUTTONS (MOMENTARY CONTACT)

NOTE XXX:

AM = AUTO/MANUAL	CM = COMPUTER/MANUAL
CAM = COMPUTER/AUTO/MANUAL	CL = COMPUTER/LOCAL
FR = FORWARD/REVERSE	FOR = FORWARD/OFF/REVERSE
FS = FAST/SLOW	FOS = FAST/OFF/SLOW
HO = HAND/OFF	LR = LOCAL/REMOTE
LOS = LOCKOUT/STOP	MFS = MODULATE FASTER/SLOWER
MOC = MODULATE OPEN/CLOSE	OC = OPEN/CLOSE
OO = ON/OFF	OSC = OPEN/STOP/CLOSE
SS = START/STOP	

1. "A", WHEN ADDED TO NOTATION, INDICATES AUTO. EXAMPLE: HOA = HAND/OFF/AUTO
2. "R", WHEN ADDED TO NOTATION, INDICATES REMOTE. EXAMPLE: HOR = HAND/OFF/REMOTE

ANALYSIS INSTRUMENTS

EXPOSED PROBE OR GAS DETECTOR

TAPPED OR SAMPLED

IN-LINE (FLOW THROUGH)

NOTE XXX:

COL = COLOR	CDG = CARBON DIOXIDE GAS
CG = COMBUSTIBLE GAS	CH4 = METHANE
CLG = CHLORINE GAS	CLR = CHLORINE RESIDUAL
COG = CARBON MONOXIDE GAS	DO = DISSOLVED OXYGEN
HC = HYDROCARBONS	HUM = HUMIDITY
H2S = HYDROGEN SULFIDE	MKO = CONDUCTIVITY
NH4 = AMMONIA	N2G = NITROGEN GAS
OG = OXYGEN GAS	OZG = OZONE GAS
PH = pH	SD = SOLIDS DENSITY
SO2 = SULPHUR DIOXIDE GAS	SS = SUSPENDED SOLIDS
TOC = TOTAL ORGANIC CARBON	TRB = TURBIDITY

EQUIPMENT SYMBOLS

- CENTRIFUGAL PUMP (DRY PIT)
- CENTRIFUGAL COMPRESSOR OR BLOWER
- RECIPROCATING PUMP (PD)
- RECIPROCATING COMPRESSOR (PD)
- ROTARY PUMP (PD)
- ROTARY COMPRESSOR (PD)
- CENTRIFUGAL PUMP (WET PIT)
- MOTOR
- SCREW PUMP
- MIXER
- HEAT EXCHANGER
- EJECTOR

NOTE XX: BLANK = CONSTANT SPEED; 2S = TWO SPEED; VS = VARIABLE SPEED

INSTRUMENT TAGGING

LLLL = FUNCTIONAL INSTRUMENT IDENTIFICATION FROM TABLE

NNNN = LOOP NUMBER

COMMONLY USED INSTRUMENT IDENTIFICATION LETTER COMBINATIONS DEVELOPED FROM CHART AT LEFT (UNLESS NOTED AS CUSTOM SYMBOL):

COMBINATION	DESCRIPTION
AE	ANALYZER PRIMARY ELEMENT
FE	FLOW PRIMARY ELEMENT
LE	LEVEL PRIMARY ELEMENT
PE	PRESSURE PRIMARY ELEMENT
FCV	FLOW CONTROL VALVE (FINAL ELEMENT)
FIT	FLOW INDICATING TRANSMITTER
LIT	LEVEL INDICATING TRANSMITTER
AIT	ANALYSIS INDICATING TRANSMITTER
PIT	PRESSURE INDICATING TRANSMITTER
FAL	FLOW ALARM LOW
LAH	LEVEL ALARM HIGH
FI	FLOW INDICATOR
PI	PRESSURE INDICATOR
LI	LEVEL INDICATOR
FIR	FLOW INDICATING RECORDER
FIRQ	FLOW INDICATING RECORDER WITH TOTALIZER
FIC	FLOW INDICATING CONTROLLER
KC	TIMER
CR	CONTROL RELAY
I/I	CURRENT TO CURRENT CONVERTER (LOOP ISOLATOR)
FY	FLOW COMPUTING RELAY
UT	TELEPHONE DIALER
MN	MOTOR STATUS
MO	MOTOR OVERLOAD
FMR	FM RADIO (CUSTOM SYMBOL)
RTU	REMOTE TERMINAL UNIT (CUSTOM SYMBOL)
MTU	MASTER TERMINAL UNIT (CUSTOM SYMBOL)
PS	POWER SUPPLY (CUSTOM SYMBOL)
I/O	INPUT/OUTPUT MODULE (CUSTOM SYMBOL)
PT	PRESSURE TRANSDUCER (CUSTOM SYMBOL)
A/D	ANALOG TO DIGITAL CONVERTER (CUSTOM SYMBOL)
D/A	DIGITAL TO ANALOG CONVERTER (CUSTOM SYMBOL)
PCM	PUMP CONTROL MODULE (CUSTOM SYMBOL)
TSG	THUMBWHEEL SETPOINT GENERATOR (CUSTOM SYMBOL)
MNC	MOTOR CALLED FOR
MNF	MOTOR FAILED
DFA	DATA FAIL ALARM

MISCELLANEOUS SYMBOLS

- DIAPHRAGM SEAL
- TRANSIENT SUPPRESSOR
- RUPTURE DISK (PRESSURE RELIEF)
- SIGHT GLASS NOTE: X W = WATER A = AIR
- RUPTURE DISK (VACUUM RELIEF)
- FLOW STRAIGHTENER
- (REGULATED SIDE) PRESSURE REGULATOR
- DIFFERENTIAL PRESSURE REGULATOR
- PRESSURE GAUGE
- ANTENNA (GENERIC)
- VENT TO ATMOSPHERE
- INTERLOCK LOGIC
- RESET
- AIR GAP
- SQUARE ROOT EXTRACTOR
- SIGNAL CONTINUATION WHERE X = 1,2,3,ETC.
- SNUBBER

GENERAL INSTRUMENT OR FUNCTION SYMBOLS

	DISCRETE INSTRUMENT	SHARED DISPLAY/ SHARED CONTROL	COMPUTER FUNCTION
FIELD MOUNTED	○	□	⬡
FRONT OF PANEL MOUNTED	⊖	▭	⊖
INTERIOR OF PANEL MOUNTED	⊖	▭	⊖
MOTOR CONTROL CENTER MOUNTED	⊖	▭	⊖
INSTRUMENTS SHARING A COMMON HOUSING	∞	▭	⬡
ANNUNCIATOR	⌑	▭	⌑

PRIMARY ELEMENT SYMBOLS

FLOW

- ELECTROMAGNETIC
- ULTRASONIC IN-LINE
- ULTRASONIC CLAMP-ON OR DOPPLER
- VENTURI
- ORIFICE PLATE
- PROPELLER OR TURBINE
- VORTEX SHEDDING
- TARGET
- PITOT TUBE
- ROTAMETER
- FLUME
- WEIR
- UNCLASSIFIED FLOW ELEMENT: X = E SWITCH: X = S

LEVEL

- BUBBLE TUBE
- ULTRASONIC
- CAPACITANCE
- ELECTRODES (WITH HOLDER)
- FLOAT
- UNCLASSIFIED LEVEL ELEMENT: X = E SWITCH: X = S

TEMPERATURE

- TEMPERATURE WITH WELL

ACTUATOR SYMBOLS

- PNUEMATIC
- ELECTROPNEUMATIC
- HYDRAULIC
- ELECTROHYDRAULIC
- ELECTRIC NOTE: XX = PZ, HZ OR MZ INDICATES ACTUATOR WITH POSITIONER
- PRESSURE OR VACUUM RELIEF SPRING OR WEIGHT LOADED
- MANUAL
- SOLENOID

NOTE: ON LOSS OF PRIMARY POWER (PNEUMATIC OR ELECTRICAL)

XX-FO = FAIL OPEN
FC = FAIL CLOSED
FI = FAIL TO INTERMEDIATE POSITION
BLANK = FAIL TO LAST POSITION

VALVE & GATE SYMBOLS

- BUTTERFLY VALVE, DAMPER OR LOUVER
- CHECK VALVE
- GLOBE, GATE, PINCH OR OTHER IN-LINE VALVE
- BALL VALVE
- THREE WAY VALVE (ARROWS INDICATE FLOW PATTERN)
- TELESCOPING VALVE
- SLUICE GATE
- PREFABRICATED SLIDE GATE

INSTRUMENT LINE SYMBOLS

(LINES TO BE DRAWN FINE IN RELATION TO PROCESS PIPING LINES)

- CONNECTION TO PROCESS
- PNEUMATIC SIGNAL
- ELECTRIC ---------- OR ~~~~~~~~~~
- HYDRAULIC SIGNAL
- CAPILLARY TUBE
- ELECTROMAGNETIC OR SONIC SIGNAL (GUIDED)
- ELECTROMAGNETIC OR SONIC SIGNAL (NOT GUIDED)
- INTERNAL SYSTEM LINK (SOFTWARE OR DATA LINK)
- MECHANICAL LINK

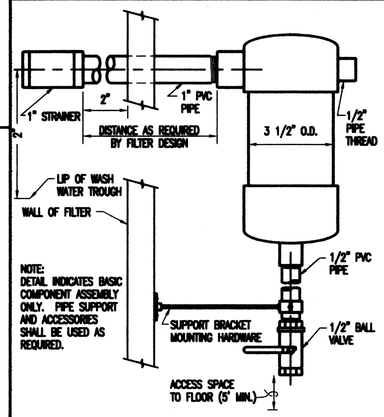
ABREVIATIONS/ACRONYMS

AS	AIR SUPPLY	ES	ELECTRIC SUPPLY
GS	GAS SUPPLY	HS	HYDRAULIC SUPPLY
WS	WATER SUPPLY	CO	CONTACT OUTPUT
CI	CONTACT INPUT	PD	POSITIVE DISPLACEMENT
FMR	FM RADIO	MTU	MASTER TERMINAL UNIT
RTU	REMOTE TERMINAL UNIT		

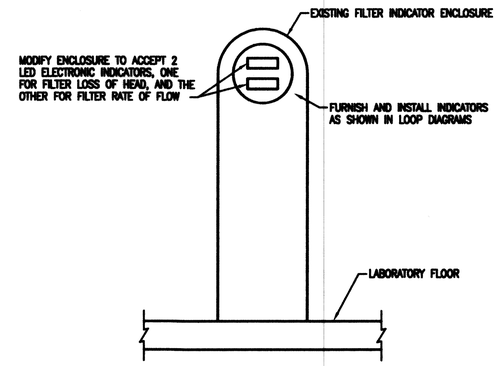
GENERAL NOTES:

SEE DIVISION 11, 13 AND 16 OF THE SPECIFICATIONS FOR FURTHER INSTRUMENTATION REQUIREMENTS.

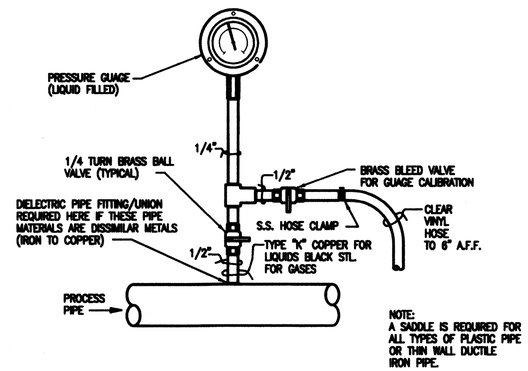
THIS IS A GUIDE TO READING INSTRUMENT SOCIETY OF AMERICA (ISA) FORMAT P&ID OR LOOP DIAGRAMS. THESE SYMBOLS AND TECHNIQUES ARE MOSTLY EXTRACTED FROM ISA STANDARD S5.1. THIS IS NOT HOWEVER, A COMPLETE OR EXACT DUPLICATION OF S5.1. NOT ALL SYMBOLS SHOWN ARE USED ON THIS PROJECT. SOME SYMBOLS MAY BE USED THAT ARE NOT SHOWN. CONTACT THE ENGINEER OR THE ISA STANDARD S5.1 FOR CLARIFICATIONS.



STRAINER/MUDLEG ASSEMBLY (ICS1.6 (TYP.))
NOT TO SCALE

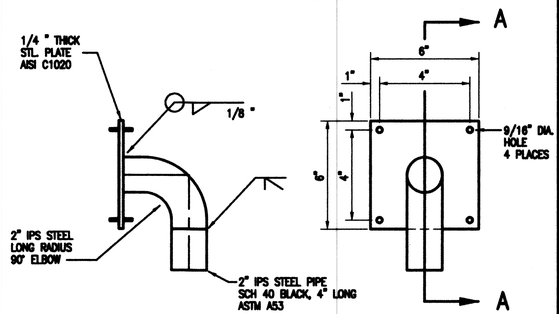


FILTER AREA INDICATOR DETAIL (ICS1.1 C-7)
2 REQUIRED- NOT TO SCALE



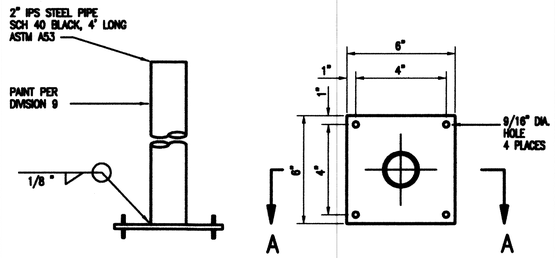
NOTE:
A SADDLE IS REQUIRED FOR ALL TYPES OF PLASTIC PIPE OR THIN WALL DUCTILE IRON PIPE.

PRESSURE GAUGE PIPING DETAIL (ICS1.2 (TYP.))
NOT TO SCALE



SECTION A PLAN

WALL BRACKET



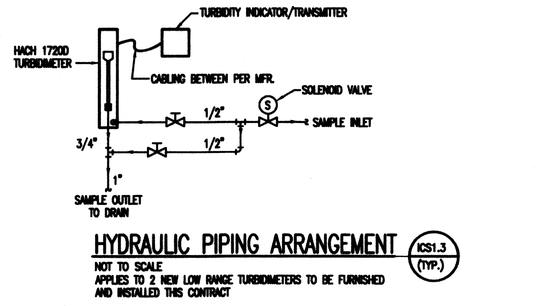
SECTION A PLAN

FLOOR STAND

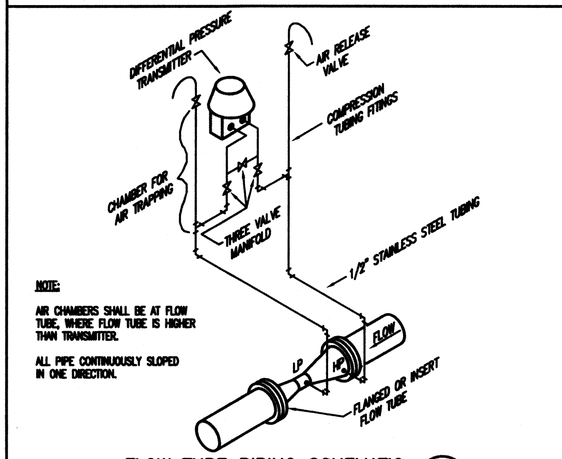
INSTRUMENT MOUNTING BRACKETS (ICS1.4 (TYP.))
NOT TO SCALE

MOUNT BRACKETS USING NON MAGNETIC STAINLESS STEEL ANCHOR BOLTS.

PAINT ENTIRE BRACKET PRIOR TO INSTALLATION, INCLUDING CONCEALED SURFACES.



HYDRAULIC PIPING ARRANGEMENT (ICS1.3 (TYP.))
NOT TO SCALE
APPLIES TO 2 NEW LOW RANGE TURBIDIMETERS TO BE FURNISHED AND INSTALLED THIS CONTRACT



NOTE:
AIR CHAMBERS SHALL BE AT FLOW TUBE, WHERE FLOW TUBE IS HIGHER THAN TRANSMITTER.

ALL PIPE CONTINUOUSLY SLOPED IN ONE DIRECTION.

FLOW TUBE PIPING SCHEMATIC (ICS1.5 (TYP.))
NOT TO SCALE
(FOR APPLICATIONS WHERE TUBE IS BELOW TRANSMITTER)

NO.	DESCRIPTION	DATE	BY

REVISIONS

WILLIAM LAMONT HANKARD — REGISTERED ENGINEER — No. 109277 — STATE OF TENNESSEE

GRW PROJECT NO. 7385

WATER TREATMENT PLANT EXPANSION
LOBELVILLE, TENNESSEE
REHABILITATION & UPGRADE
INSTRUMENTATION SYMBOLOGY & DETAILS

GRW Engineers, Inc.
Engineers, Architects, Planners
LEXINGTON LOUISVILLE NASHVILLE INDIANAPOLIS

DESIGNED: KRS	DATE: DECEMBER, 1998
DRAWN: GAM	SCALE: AS NOTED
REVIEWED: KRS	SHEET NO. ICS-1
APPROVED: JWH	

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